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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/500,737	07/06/2004	Yasuo Imamura	254914US0PCT	6688
22850 7590 06/13/2008 OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER LIAO, DIANA J				
ART UNIT 1793		PAPER NUMBER		
NOTIFICATION DATE 06/13/2008		DELIVERY MODE ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com  
oblonpat@oblon.com  
jgardner@oblon.com

### Office Action Summary

**Application No.**

10/500,737

**Applicant(s)**

IMAMURA ET AL.

**Examiner**

DIANA J. LIAO

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**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 28 January 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 1-3 and 9 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 4-8 and 10-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-8508)  
Paper No(s)/Mail Date 1/28/08
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Status of Application***

1. Claims 4-8 and 10-15 are presented for examination. Claims 1-3 and 9 have been previously withdrawn. Claims 4 and 5 have been amended and claims 10-15 are new. Objection to claim 5 has been withdrawn.

### ***Claim Objections***

2. Claims 4-8 and 10-15 objected to because of the following informalities: Please draft process claim 4 in independent claim form. Claims should not be dependent on a non-elected product. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 4-8 and 10-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar, et al. (US 6,726,990) in view of Bergonzo, et al. ("Rapid photo-deposition of silicon dioxide..." 1994).

Kumar '990 teaches the formation of silicon oxide particles with a stoichiometry of  $\text{SiO}_x$  where  $1 \leq x \leq 2$ . (col 2, lines 54-55) It is stated that these particles can have a purity of 99.9 wt.%. (col 9, lines 40-43) It is also more specifically stated that the particles contain less than about 0.00001 percent by weight metal. (claim 5) Since 1ppm is generally understood to be 0.0001 percent, the collection of particles contain less than about 0.1ppm other metals. The surface area of the example product is 264  $\text{m}^2/\text{g}$ . (col 12, lines 27-30) The temperature that is disclosed to be appropriate for processing is 50-800°C. (col 8, lines 36-38) The particles in the examples are created using an oxidation reaction between the vapor of  $\text{SiCl}_4$  and an oxygen source, such as oxygen. The reaction is heated through use of a laser and a radiation absorber, in this case ethylene. This process also utilizes an inert atmosphere of argon, which also serves as a carrier gas. (col 11, lines 21-38) The pressures generally range from 80-500 torr, or about 10-67 kPa. (col 11, Table 1) Increasing laser power leading to increased temperature, varying pressure, and the amount of reactant serving as the oxygen source can affect the product. Specifically increasing the oxygen source gas will increase the amount of oxygen in the particles and increasing pressure would favor the production of higher energy structures. (col 3, lines 9-18) The product taught in Kumar '990 is purified by heat treatment in an oven where any carbon on the product is either removed, or the stoichiometry is shifted towards  $\text{SiO}_2$ . The gases for the heat treatment

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are supplied through quartz tubes. (col 12, lines 42-60) A collection apparatus (106) is used to filter out particles. (Figure 1)

Regarding the means for heating, Kumar '990 teaches a method which imparts energy and heat to the reactants through a laser, directly heating the reactants and the reaction, while the instant claims utilize an indirect heating technique by heating the periphery of the reactor. The means for heating the reaction, or in other words, the means for imparting energy into the reaction to improve kinetics, is found to be obvious in view the prior art. Both means for heating are equivalent and well known in the art, and thus the substitution of the means is not found to be patentable over the prior art.

Regarding the residual time of the reactants, the amount of time spent in a reactor is found to be a matter of optimization and design choice. Residual time, or residence time, is a well known parameter in process systems, and it would have been obvious to one of ordinary skill in the art to adjust this time to create the desired product depending on the pressure, amount of reactants, or temperature for example. A reaction whose kinetics are high due to high temperature would be adjusted to experience a shorter residence time.

Regarding quartz tubes, Kumar '990 teaches the use of quartz tubes for oxygen in the heat treatment step but not in the reacting step. However, this is an apparatus limitation which appears to have no effect on the claimed process itself, it is not found patentable over the art. Kumar '990 fairly suggests that quartz is a suitable material to make a gas introduction tube with by using a quartz tube later in the process.

Regarding when to combine the reactant gases, Kumar '990 teaches that the gases are mixed well before introduction into the reaction chamber. (col 4, lines 35-38) Even though the claimed process does not mix the gases before introduction into the chamber, the limitation is still not found patentable over the prior art. One of the goals of Kumar '990 is to create a product of high uniformity in size. (col 9, lines 11-12) The uniformity is due to small reaction area and rapid quench of the particles. (col 9, lines 29-31) Pre-mixing, as taught in Kumar '990 would be advantageous to ensure contact between reactants within a small reactor. However, if uniformity or efficiency is not a necessary in the product, it would not be necessary to mix the reactants beforehand. Alternatively, without a direct showing of otherwise, the reordering of process steps which does not appear to affect the product is found to be obvious over the prior art. In this case, the claimed simultaneous heating and mixing and the mixing and then heating of the prior art are not found to be patentably distinct. See *In re Burhans* 69 USPQ 330.

Regarding temperature and pressure, Kumar '990 teaches overlapping ranges. The narrowest claimed ranges are 650°C-850°C and 50-300kPa. Without a reasoning for criticality and given that Kumar '990 offers general teachings of the effect of temperature (through laser power) and pressure variations on the final product, the claimed ranges for pressure and temperature are not found patentable over the prior art. Overlapping ranges creates a *prima facie* case of obviousness.

Regarding a specific ppm value for Fe, Na, Al and Cl components, Kumar '990 teaches the lack of metal impurities and only suggests carbon to be an impurity. The lack of metal impurities at any higher than 0.1ppm suggest a lack of a significant

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contribution of Al, Fe, or Na. The general purity taught by Kumar '990, 99.9 wt.%, is very high and no impurities are mentioned, suggesting that there is also no chlorine in the product. Therefore, limitations regarding impurity content is not found patentable over the prior art.

Regarding the molar ratio of gases, Kumar teaches the molar ratio of non-oxidizing gas to oxygen varying from 2.6 to 5.2, if all argon components are added together and compared to the oxygen component. (Table 1) However, the amount of silane is not given. Assuming the ratio of Si containing gas to oxygen containing gas is 1 to 1 on a molar basis, if both are completely reacted then the ratios range from 1.75 to 3.5 in the examples given in Kumar '990. This is considered to read upon the claim of a range of a molar ratio of at least 2. In addition, varying the amount of inert gas in order to increase or decrease pressure is well known in the art. Since Kumar '990 discloses pressure to have a known effect on the product, it would be obvious to one of ordinary skill in the art to find an amount of non-oxidizing gas.

Kumar '990 does not specifically teach  $\text{SiH}_4$  as a suitable silicon source in the production of silicon oxide.

Bergonzo, et al. teaches the production of a silicon dioxide film using  $\text{SiH}_4$  and  $\text{O}_2$  and CVD techniques. (page 607)

It would have been obvious to one of ordinary skill in the art to use  $\text{SiH}_4$  as a silicon source in making silicon oxide in view of Bergonzo. Kumar '990 teaches that

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appropriate silicon precursors include compounds with reasonable vapor pressures so that there is enough silicon source in the vapor stream. (col 3, lines 31-36) Although Kumar '990 utilizes chlorine substituted monosilanes in its process, it would have been obvious to use  $\text{SiH}_4$  as long as the vapor pressure was sufficient. In addition, Bergonzo teaches  $\text{SiH}_4$  to be a known silicon source for silicon oxide.

Therefore, the use of monosilane gas ( $\text{SiH}_4$ ) is not found patentable over the prior art.

Due to overlapping ranges for temperature, pressure, and values of x, reordering of process steps, routine optimization of process conditions and the substitution of known alternatives, claims 4-8 and 10-15 are not found patentable over the prior art.

### ***Response to Arguments***

6. Applicant's arguments with respect to claims 4-8 regarding the use of monosilane gas as defined by  $\text{SiH}_4$  have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant's arguments filed 1/28/2008 have been fully considered but they are not persuasive.

Applicant argues that purity of the product produced by the process of Kumar '990 is lower than that of the instant application. Differences pointed out between the prior art and the instant application are that the prior art teaches that the reactants are



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mixed before reaching the reactor, the product has a dark color which needs to be purified, there is no teaching of a Na, Fe, Al, or Cl impurity of less than 10ppm, and the silane precursor is not  $\text{SiH}_4$ .

The difference between when the reactants are mixed, the existence of lack of a Na, Fe, Al, of Cl impurity and the silane precursor is discussed above. The process steps were found to be obvious, the lack of those impurities was found to be suggested, and  $\text{SiH}_4$  was found to be obvious in view of Bergonzo, et al. The original ground of rejection was proper on the claim reciting "a monosilane gas", which included  $\text{SiCl}_4$  which the amended deletion of "a" overcame. Golecki '968 was introduced to show that  $\text{SiH}_4$  could be used as a silicon precursor, which was shown.

The arguments regarding purity of the product as produced by Kumar '990 is not found to be persuasive. The claims require a powder of a particular surface area and a substantial lack of Na, Fe, Al and Cl. Kumar '990, as discussed above, is found to meet all of these limitations. The claimed process comprises the recited steps, and does not exclude an additional purification step as in Kumar '990. In addition, Kumar '990 only mentions a carbon impurity, which is later removed. All limitations of the process have been addressed and have not been found patentable over the prior art.

***Conclusion***

Claims 4-8 and 10-15 have been rejected. No claims have been allowed.

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANA J. LIAO whose telephone number is (571)270-3592. The examiner can normally be reached on Monday - Friday 8:00am to 5:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 571-272-1358. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/  
Primary Examiner, Art Unit 1793

DJL